

19 Portugal Place
Cambridge.

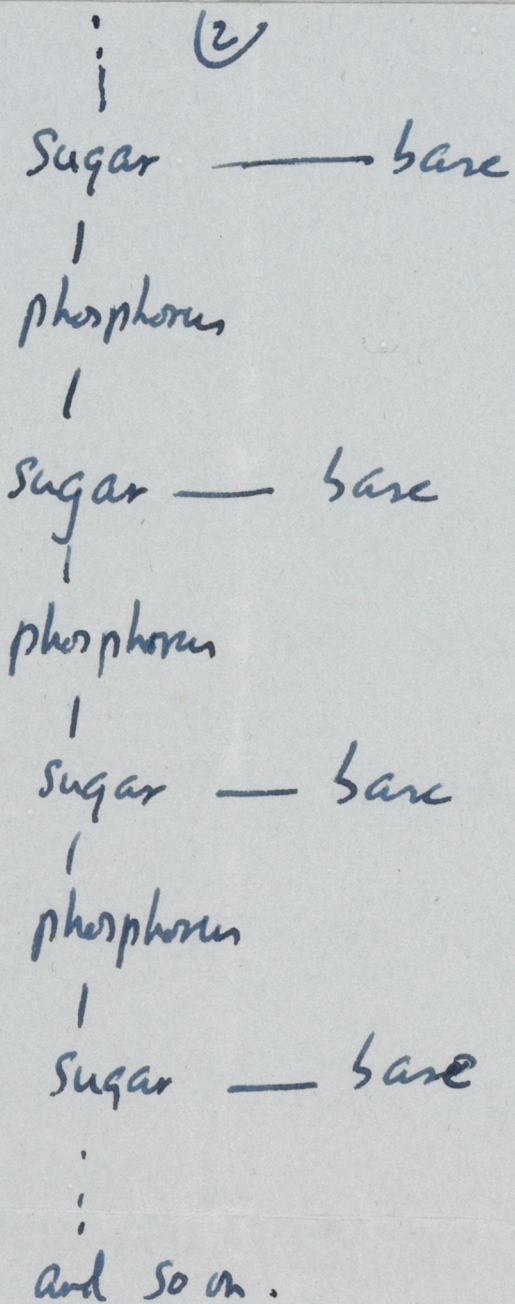
15 March '53

My Dear Michael,

Jim Watson and I have probably made a most important discovery. We have built a model for the structure of des-oxy-ribose-nucleic-acid (read it carefully) called D.N.A. for short. You may remember that the genes of the chromosomes - which carry the hereditary factors - are made up of protein and D.N.A.

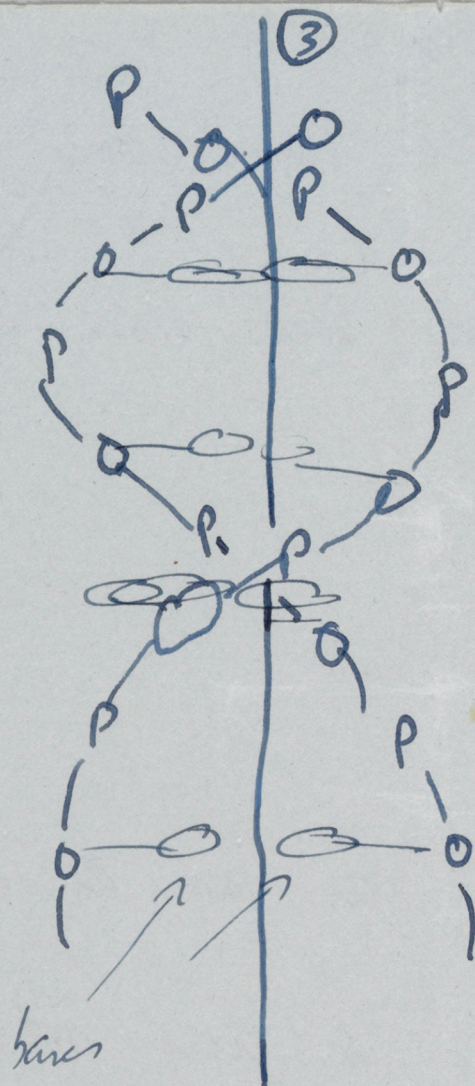
Our structure is very beautiful. D.N.A. can be thought of roughly as a very long chain with flat bits ~~flat~~ sticking out. The flat bits are called the "bases". The formula is rather

like this



Now we have two ~~the~~ of these chains winding round each other — each one is a helix — and the chain, made up of sugar and phosphorus, is on the outside, and the bases are all on the inside. I can't draw it very well, but it looks

Like this



The model looks much nicer than this.

Now the exciting thing is that while there are 4 different bases, we find we can only put ~~them~~ certain pairs of them together. The bases have names. They are Adenine, Guanine, Thymine + Cytosine. I will call them A, G, T and C. Now we find that the ~~to~~ pairs

(4)

We can make - which have one base from
one chain joined to one base from another - are
only A with T
and G with C.

Now on one chain, as far as we can see,
one can have the bases in any order, but if that
order is fixed, then the order on the other
chain is also fixed. For example, suppose the
first chain goes ↓ then the second must go

A	- - - - -	T
T	- - - - -	A
C	- - - - -	G
A	- - - - -	T
G	- - - - -	C
T	- - - - -	A
T	- - - - -	A

(5)

It is like a code. If you ~~are~~ are given one set of letters you can write down the others.

Now we believe that the D.N.A. is a code.

That is, the order of the bases (the letters) makes one gene different from another gene (just as one page of print is different from another).

You can now see how Nature makes copies of the genes. Because if the two chains unwind into two separate chains, and if each chain then makes another chain to come together on it, then because A always goes with T, and G with C, we shall get two ~~or~~ copies where

⑥

we had one before.

For example

A - T
T - A
C - G
A - T
~~G~~ - C
T - A
T - A

Chains
Separate

A
T
C
A
G
T
T

T
A
G
T
C
A
A

↓
new chains form

A - T
T - A
C - G
A - T
G - C
T - A
T - A

T - A
A - T
G - C
T - A
C - G
A - T
A - T

(7)

In other words $\frac{1}{2}$ we think we have found the basic copying mechanism by which life comes from life.

The beauty of our model is that the shape of it is such that only these pairs can go together, though they could pair up in other ways if they were floating about freely. You can understand that we are very excited. We have to have

a letter off to Nature in a day or so.

~~Read~~ Read this carefully so that you understand it. When you come home we will

show you the model.

Lots of love,

Daddy